

In the Claims:

Please cancel claims 16-24 and amend claims 11-13 and 15 as indicated in the attached "**Version with Markings to Show Changes Made**". The complete set of pending claims 1-15, in amended form, is as follows:

A 1. A semiconductor product comprising a barrier layer disposed between a copper-containing structure and a low-k dielectric film, said barrier layer comprising a composite film structure including a nitrogen-containing, substantially oxygen-free first film forming a boundary with said copper-containing structure and an oxygen-containing, substantially nitrogen-free second film forming a boundary with said low-k dielectric film.

2. The semiconductor product as in claim 1, in which said first film comprises nitrogen-doped silicon carbide, and said second film comprises oxygen-doped silicon carbide.

3. The semiconductor product as in claim 1, in which first film comprises silicon nitride and said second film comprises silicon dioxide.

4. The semiconductor product as in claim 1, in which said copper-containing structure comprises a surface including a copper wire formed within an insulating material.

5. The semiconductor product as in claim 1, in which said barrier layer is formed on said copper-containing structure and said low-k dielectric film is formed on said barrier layer.

6. The semiconductor product as in claim 5, further comprising an oxygen-doped silicon carbide film formed over said low-k dielectric film, a further low-k dielectric film formed over said oxygen-doped silicon carbide film and an oxygen-doped silicon carbide hardmask formed over said further low-k dielectric film.

7. The semiconductor product as in claim 6, in which said semiconductor product includes a two-tiered opening extending down from a top surface of said oxygen-doped silicon carbide hardmask, said two-tiered opening including a wider upper portion extending through said oxygen-doped silicon carbide hardmask, said further low-k dielectric film, and said oxygen-doped silicon carbide film, and a lower, narrower portion extending through said low-k dielectric film, said second film, and said first film.

AI 8. The semiconductor product as in claim 1, wherein said low-k dielectric film is formed of SiOC-H.

9. The semiconductor product as in claim 1, wherein said low-k dielectric film has a dielectric constant less than 3.5.

10. A semiconductor product comprising a barrier layer disposed between a readily-oxidizable conductive material and a low-k dielectric film, said barrier layer comprising a composite film structure including a nitrogen-containing, substantially oxygen-free first film forming a boundary with said conductive material and an oxygen-containing, substantially nitrogen-free second film forming a boundary with said low-k dielectric film.

11. (Amended) A semiconductor product comprising a film stack including:
a lower low-k dielectric film;
an etch-stop layer formed over said low-k dielectric film;
an upper low-k dielectric film formed over said etch-stop layer; and
a hardmask layer formed over said upper low-k dielectric film, each of said etch-stop layer and said hardmask layer formed of oxygen-doped silicon carbide.

12. (Amended) The semiconductor product as in claim 11, in which said film stack includes a two-tiered opening formed therein, said two-tiered opening including a wider upper portion disposed over a narrower lower portion,
said narrower lower portion extending through said lower low-k dielectric film,

said wider upper portion extending through said etch-stop layer, said upper low-k dielectric film and said hardmask layer, and

said two-tiered opening filled with a conductive material.

13. (Amended) The semiconductor product as in claim 12, further comprising a composite film structure formed beneath said lower low-k dielectric film and including a nitrogen-doped silicon carbide film formed beneath an oxygen-doped silicon carbide film, and wherein said narrower lower portion further extends through said composite film structure and said two-tiered opening extends to a bottom surface formed of a further conductive material.

AI 14. The semiconductor product as in claim 13, wherein said further conductive material comprises copper.

15. (Amended) A semiconductor product comprising a film stack including:
a copper-containing surface;
a nitrogen-containing first barrier layer disposed over said copper-containing surface;
an oxygen-doped, substantially nitrogen-free second barrier layer disposed over said first barrier layer;
a first low-k dielectric film disposed on said second barrier layer;
an oxygen-doped silicon carbide etch-stop layer disposed over said first low-k dielectric film;
a second low-k dielectric film disposed over said etch-stop layer; and
an oxygen-doped silicon carbide hardmask film disposed over said second low-k dielectric film.
